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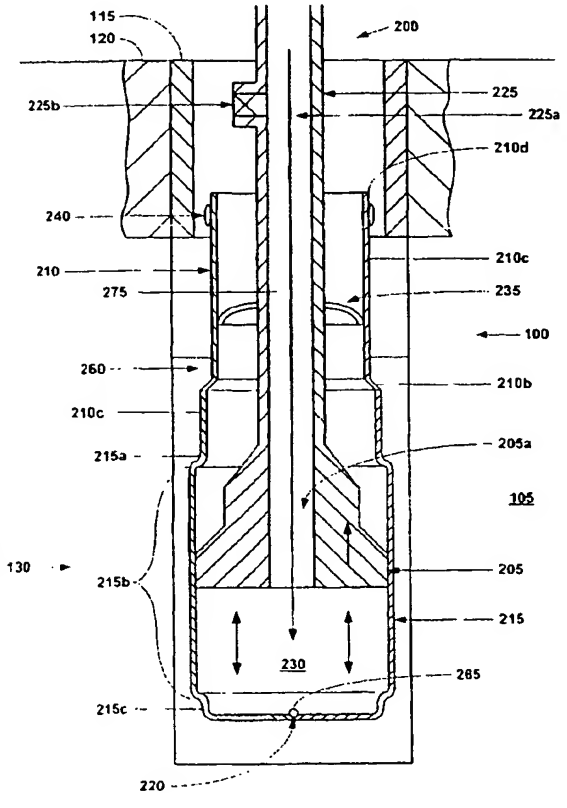
(54) Title: MONO-DIAMETER WELLBORE CASING

(57) Abstract: A mono-diameter wellbore casing.



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B. FIELDS SEARCHED

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U.S. : 166/380, 207, 212, 216, 217

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002/0033261 A1 (METCALFE) 21 March 2002 (21.03.02), summary.	1-55
A	US 6,085,838 A (VERCAEMER et al.) 11 July 2000 (11.07.02), figures 5-7.	1-55

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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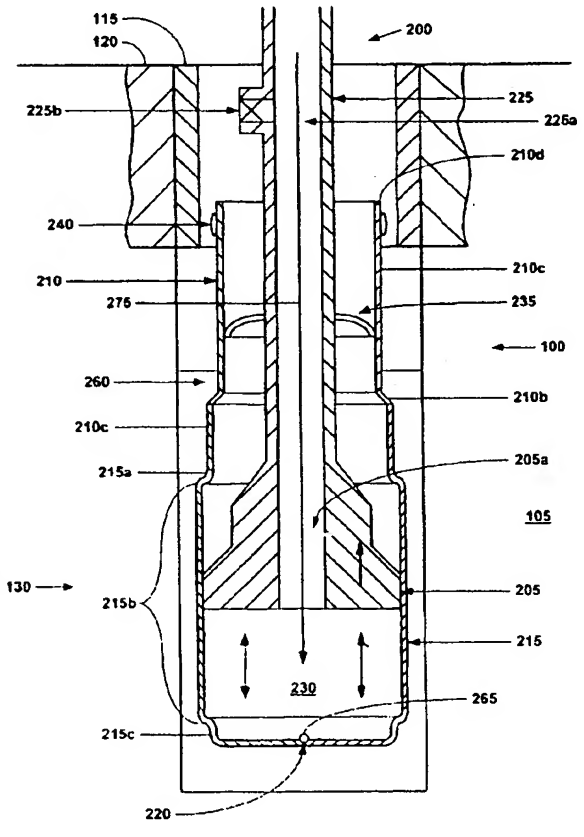
(54) Title: MONO-DIAMETER WELLBORE CASING



(57) Abstract: A mono-diameter wellbore casing.

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Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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AMENDED CLAIMS

[Received by the International Bureau on 15 July 2004 (15.07.04): original claims 1 - 55 amended; new claims 56 - 78 added (2 pages)]

Claims

1. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:

a support member including a first fluid passage;

an expansion cone coupled to the support member including a second fluid passage fluidicly coupled to the first fluid passage;

an expandable tubular liner movably coupled to the expansion cone; and

an expandable shoe coupled to the expandable tubular liner;

wherein the expansion cone is adjustable to a plurality of stationary positions.

2. The apparatus of claim 1, wherein the expandable shoe includes a valveable fluid passage for controlling the flow of fluidic materials out of the expandable shoe.

3. The apparatus of claim 1, wherein the expandable shoe includes:

an expandable portion; and

a remaining portion coupled to the expandable portion;

wherein the outer circumference of the expandable portion is greater than the outer circumference of the remaining portion.

4. The apparatus of claim 3, wherein the expandable portion includes:

one or more inward folds.

5. The apparatus of claim 3, wherein the expandable portion includes:

one or more corrugations.

6. The apparatus of claim 1, wherein the expandable shoe includes:

one or more inward folds.

7. The apparatus of claim 1, wherein the expandable shoe includes:

one or more corrugations.

8. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an adjustable expansion cone, and a shoe in the borehole;
radially expanding at least a portion of the shoe by a process comprising:
adjusting the adjustable expansion cone to a first outside diameter; and
injecting a fluidic material into the shoe; and
radially expanding at least a portion of the tubular liner by a process comprising:
adjusting the adjustable expansion cone to a second outside diameter; and
injecting a fluidic material into the borehole below the expansion cone.

9. The method of claim 8, wherein the first outside diameter of the adjustable expansion cone is greater than the second outside diameter of the adjustable expansion cone.

10. The method of claim 8, wherein radially expanding at least a portion of the shoe further comprises:
lowering the adjustable expansion cone into the shoe; and
adjusting the adjustable expansion cone to the first outside diameter.

11. The method of claim 8, wherein radially expanding at least a portion of the shoe further comprises:
pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and
pressurizing an annular region above the adjustable expansion cone using the fluidic material.

12. The method of claim 8, wherein radially expanding at least a portion of the tubular liner further comprises:
pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and
pressurizing an annular region above the adjustable expansion cone using the fluidic material.

13. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:
means for installing a tubular liner, an adjustable expansion cone, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:
means for adjusting the adjustable expansion cone to a first outside diameter; and
means for injecting a fluidic material into the shoe; and
means for radially expanding at least a portion of the tubular liner comprising:
means for adjusting the adjustable expansion cone to a second outside diameter; and
means for injecting a fluidic material into the borehole below the adjustable expansion cone.

14. The system of claim 13, wherein the first outside diameter of the adjustable expansion cone is greater than the second outside diameter of the adjustable expansion cone.

15. The system of claim 13, wherein the means for radially expanding at least a portion of the shoe further comprises:
means for lowering the adjustable expansion cone into the shoe; and
means for adjusting the adjustable expansion cone to the first outside diameter.

16. The system of claim 13, wherein the means for radially expanding at least a portion of the shoe further comprises:
means for pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and
means for pressurizing an annular region above the adjustable expansion cone using the fluidic material.

17. The system of claim 13, wherein the means for radially expanding at least a portion of the tubular liner further comprises:
means for pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and
means for pressurizing an annular region above the adjustable expansion cone using the fluidic material.

18. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

a first wellbore casing comprising:
an upper portion of the first wellbore casing; and
a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;
wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and
a second wellbore casing comprising:
an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and
a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;
wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and
wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;
wherein the second wellbore casing is coupled to the first wellbore casing by the process of:
installing the second wellbore casing and an adjustable expansion cone within the borehole;
radially expanding at least a portion of the lower portion of the second wellbore casing by a process comprising:
adjusting the adjustable expansion cone to a first outside diameter; and
injecting a fluidic material into the second wellbore casing; and
radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:
adjusting the adjustable expansion cone to a second outside diameter; and
injecting a fluidic material into the borehole below the adjustable expansion cone.

19. The wellbore casing of claim 18, wherein the first outside diameter of the adjustable expansion cone is greater than the second outside diameter of the adjustable expansion cone.

20. The wellbore casing of claim 18, wherein radially expanding at least a portion of the lower portion of the second wellbore casing further comprises:

lowering the adjustable expansion cone into the lower portion of the second wellbore casing; and

adjusting the adjustable expansion cone to the first outside diameter.

21. The wellbore casing of claim 18, wherein radially expanding at least a portion of the lower portion of the second wellbore casing further comprises:

pressurizing a region within the lower portion of the second wellbore casing below the adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the adjustable expansion cone using the fluidic material.

22. The wellbore casing of claim 18, wherein radially expanding at least a portion of the upper portion of the second wellbore casing further comprises:

pressurizing a region within the lower portion of the second wellbore casing below the adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the adjustable expansion cone using the fluidic material.

23. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:

a support member including a first fluid passage;

a first adjustable expansion cone coupled to the support member including a second fluid passage fluidicly coupled to the first fluid passage;

a second adjustable expansion cone coupled to the support member including a third fluid passage fluidicly coupled to the first fluid passage;

an expandable tubular liner movably coupled to the first and second adjustable expansion cones; and

an expandable shoe coupled to the expandable tubular liner.

24. The apparatus of claim 23, wherein the expandable shoe includes a valveable fluid passage for controlling the flow of fluidic materials out of the expandable shoe.

25. The apparatus of claim 23, wherein the expandable shoe includes:
an expandable portion; and
a remaining portion coupled to the expandable portion;
wherein the outer circumference of the expandable portion is greater than the outer circumference of the remaining portion.

26. The apparatus of claim 25, wherein the expandable portion includes:
one or more inward folds.

27. The apparatus of claim 25, wherein the expandable portion includes:
one or more corrugations.

28. The apparatus of claim 23, wherein the expandable shoe includes:
one or more inward folds.

29. The apparatus of claim 23, wherein the expandable shoe includes:
one or more corrugations.

30. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:
installing a tubular liner, an upper adjustable expansion cone, a lower adjustable expansion cone, and a shoe in the borehole;
radially expanding at least a portion of the shoe by a process comprising:
adjusting the lower adjustable expansion cone to an increased outside diameter; and
injecting a fluidic material into the shoe; and
radially expanding at least a portion of the tubular liner by a process comprising:
adjusting the lower adjustable expansion cone to a reduced outside diameter;
adjusting the upper adjustable expansion cone to an increased outside diameter; and
injecting a fluidic material into the borehole below the lower adjustable expansion cone.

31. The method of claim 30, wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upper adjustable expansion cone.

32. The method of claim 30, wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.

33. The method of claim 30, wherein radially expanding at least a portion of the shoe further comprises:

lowering the lower adjustable expansion cone into the shoe; and

adjusting the lower adjustable expansion cone to the increased outside diameter.

34. The method of claim 30, wherein radially expanding at least a portion of the shoe further comprises:

pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material.

35. The method of claim 30, wherein radially expanding at least a portion of the tubular liner further comprises:

pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material.

36. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an upper adjustable expansion cone, a lower adjustable expansion cone, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for adjusting the lower adjustable expansion cone to an increased outside diameter; and

means for injecting a fluidic material into the shoe; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the lower adjustable expansion cone to a reduced outside diameter;

means for adjusting the upper adjustable expansion cone to an increased outside diameter; and

means for injecting a fluidic material into the borehole below the lower adjustable expansion cone.

37. The system of claim 36, wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upper adjustable expansion cone.

38. The system of claim 36, wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.

39. The system of claim 36, wherein the means for radially expanding at least a portion of the shoe further comprises:

means for lowering the lower adjustable expansion cone into the shoe; and

means for adjusting the lower adjustable expansion cone to the increased outside diameter.

40. The system of claim 36, wherein the means for radially expanding at least a portion of the shoe further comprises:

means for pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

means for pressurizing an annular region above the upper adjustable expansion cone using the fluidic material.

41. The system of claim 36, wherein the means for radially expanding at least a portion of the tubular liner further comprises:

means for pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

means for pressurizing an annular region above the upper adjustable expansion cone using the fluidic material.

42. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

a first wellbore casing comprising:

an upper portion of the first wellbore casing; and

a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;

wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and

a second wellbore casing comprising:

an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;

wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second wellbore casing, an upper adjustable expansion cone, a lower adjustable expansion cone, and a shoe in the borehole;

radially expanding at least a portion of the lower portion of the second wellbore casing shoe by a process comprising:

adjusting the lower adjustable expansion cone to an increased outside diameter; and

injecting a fluidic material into the lower portion of the second wellbore casing; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the lower adjustable expansion cone to a reduced outside diameter;

adjusting the upper adjustable expansion cone to an increased outside diameter; and

injecting a fluidic material into the borehole below the lower adjustable expansion cone.

43. The wellbore casing of claim 42, wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upper adjustable expansion cone.

44. The wellbore casing of claim 42, wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.

45. The wellbore casing of claim 42, wherein radially expanding at least a portion of the lower portion of the second wellbore casing further comprises:

lowering the lower adjustable expansion cone into the lower portion of the second wellbore casing; and

adjusting the lower adjustable expansion cone to the increased outside diameter.

46. The wellbore casing of claim 42, wherein radially expanding at least a portion of the lower portion of the second wellbore casing further comprises:

pressurizing a region within the lower portion of the second wellbore casing below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material.

47. The wellbore casing of claim 42, wherein radially expanding at least a portion of the upper portion of the second wellbore casing further comprises:

pressurizing a region within the lower portion of the second wellbore casing below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material.

48. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:

a support member including a first fluid passage;

an expansion cone coupled to the support member including a second fluid passage fluidicly coupled to the first fluid passage;

an expandable tubular liner movably coupled to the expansion cone; and

an expandable shoe coupled to the expandable tubular liner comprising:
a valveable fluid passage for controlling the flow of fluidic materials out of the expandable shoe;
an expandable portion comprising one or more inward folds; and
a remaining portion coupled to the expandable portion;
wherein the outer circumference of the expandable portion is greater than the outer circumference of the remaining portion;
wherein the expansion cone is adjustable to a plurality of stationary positions.

49. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:
installing a tubular liner, an adjustable expansion cone, and a shoe in the borehole;
radially expanding at least a portion of the shoe by a process comprising:
lowering the adjustable expansion cone into the shoe;
adjusting the adjustable expansion cone to a first outside diameter;
pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and
pressurizing an annular region above the adjustable expansion cone using the fluidic material; and
radially expanding at least a portion of the tubular liner by a process comprising:
adjusting the adjustable expansion cone to a second outside diameter;
pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and
pressurizing an annular region above the adjustable expansion cone using the fluidic material;
wherein the first outside diameter of the adjustable expansion cone is greater than the second outside diameter of the adjustable expansion cone.

50. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:
means for installing a tubular liner, an adjustable expansion cone, and a shoe in the borehole;
means for radially expanding at least a portion of the shoe comprising:
means for lowering the adjustable expansion cone into the shoe;

means for adjusting the adjustable expansion cone to a first outside diameter;

means for pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and

means for pressurizing an annular region above the adjustable expansion cone using the fluidic material; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the adjustable expansion cone to a second outside diameter;

means for pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and

means for pressurizing an annular region above the adjustable expansion cone using the fluidic material

wherein the first outside diameter of the adjustable expansion cone is greater than the second outside diameter of the adjustable expansion cone.

51. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

a first wellbore casing comprising:

an upper portion of the first wellbore casing; and

a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;

wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and

a second wellbore casing comprising:

an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;

wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second wellbore casing and an adjustable expansion cone in the borehole;

radially expanding at least a portion of the lower portion of the second wellbore casing by a process comprising:

lowering the adjustable expansion cone into the lower portion of the second wellbore casing;

adjusting the adjustable expansion cone to a first outside diameter;

pressurizing a region within the lower portion of the second wellbore casing below the adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the adjustable expansion cone using the fluidic material; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the adjustable expansion cone to a second outside diameter;

pressurizing a region within the shoe below the adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the adjustable expansion cone using the fluidic material;

wherein the first outside diameter of the adjustable expansion cone is greater than the second outside diameter of the adjustable expansion cone.

52. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:

a support member including a first fluid passage;

a first adjustable expansion cone coupled to the support member including a second fluid passage fluidicly coupled to the first fluid passage;

a second adjustable expansion cone coupled to the support member including a third fluid passage fluidicly coupled to the first fluid passage;

an expandable tubular liner movably coupled to the first and second adjustable expansion cones; and

an expandable shoe coupled to the expandable tubular liner comprising:

a valveable fluid passage for controlling the flow of fluidic materials out of the expandable shoe;

an expandable portion comprising one or more inwards folds; and

a remaining portion coupled to the expandable portion;

wherein the outer circumference of the expandable portion is greater than the outer circumference of the remaining portion.

53. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an upper adjustable expansion cone, a lower adjustable expansion cone, and a shoe in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

lowering the lower adjustable expansion cone into the shoe;

adjusting the lower adjustable expansion cone to an increased outside diameter;

pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material; and

radially expanding at least a portion of the tubular liner by a process comprising:

adjusting the lower adjustable expansion cone to a reduced outside diameter;

adjusting the upper adjustable expansion cone to an increased outside diameter;

pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material;

wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upper adjustable expansion cone; and

wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.

54. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an upper adjustable expansion cone, a lower adjustable expansion cone, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for lowering the lower adjustable expansion cone into the shoe;
means for adjusting the lower adjustable expansion cone to an increased outside diameter;
means for pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and
means for pressurizing an annular region above the upper adjustable expansion cone using the fluidic material; and
means for radially expanding at least a portion of the tubular liner comprising:
means for adjusting the lower adjustable expansion cone to a reduced outside diameter;
means for adjusting the upper adjustable expansion cone to an increased outside diameter;
means for pressurizing a region within the shoe below the lower adjustable expansion cone using a fluidic material; and
means for pressurizing an annular region above the upper adjustable expansion cone using the fluidic material;
wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upper adjustable expansion cone; and
wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.

55. A wellbore casing positioned in a borehole within a subterranean formation, comprising:
a first wellbore casing comprising:
an upper portion of the first wellbore casing; and
a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;
wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and
a second wellbore casing comprising:
an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;

wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second wellbore casing, an upper adjustable expansion cone, and a lower adjustable expansion cone in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

lowering the lower adjustable expansion cone into the lower portion of the second wellbore casing;

adjusting the lower adjustable expansion cone to an increased outside diameter;

pressurizing a region within the lower portion of the second wellbore casing below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the lower adjustable expansion cone to a reduced outside diameter;

adjusting the upper adjustable expansion cone to an increased outside diameter;

pressurizing a region within the lower portion of the second wellbore casing below the lower adjustable expansion cone using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion cone using the fluidic material;

wherein the increased outside diameter of the lower adjustable expansion cone is greater than the increased outside diameter of the upper adjustable expansion cone; and

wherein the reduced outside diameter of the lower adjustable expansion cone is less than or equal to the increased outside diameter of the upper adjustable expansion cone.

56. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:

a support member defining a first fluid passage;

an expansion device coupled to the support member defining a second fluid passage fluidicly coupled to the first fluid passage;

an expandable tubular liner movably coupled to the expansion device; and

an expandable shoe coupled to the expandable tubular liner;

wherein the expansion device is adjustable to a plurality of stationary positions.

57. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an adjustable expansion device, and a shoe in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

adjusting the adjustable expansion device to a first outside diameter; and

injecting a fluidic material into the shoe; and

radially expanding at least a portion of the tubular liner by a process comprising:

adjusting the adjustable expansion device to a second outside diameter; and

injecting a fluidic material into the borehole below the adjustable expansion device.

58. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an adjustable expansion device, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for adjusting the adjustable expansion device to a first outside diameter; and

means for injecting a fluidic material into the shoe; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the adjustable expansion device to a second outside diameter; and

means for injecting a fluidic material into the borehole below the adjustable expansion device.

59. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

a first wellbore casing comprising:

an upper portion of the first wellbore casing; and

a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;

wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and

a second wellbore casing comprising:

an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;

wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second wellbore casing and an adjustable expansion device within the borehole;

radially expanding at least a portion of the lower portion of the second wellbore casing by a process comprising:

adjusting the adjustable expansion device to a first outside diameter; and

injecting a fluidic material into the second wellbore casing; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the adjustable expansion device to a second outside diameter; and

injecting a fluidic material into the borehole below the adjustable expansion device.

60. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:

a support member including a first fluid passage;

a first adjustable expansion device coupled to the support member including a second fluid passage fluidicly coupled to the first fluid passage;

a second adjustable expansion device coupled to the support member including a third fluid passage fluidicly coupled to the first fluid passage;

an expandable tubular liner movably coupled to the first and second adjustable expansion devices; and

an expandable shoe coupled to the expandable tubular liner.

61. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

adjusting the lower adjustable expansion device to an increased outside diameter; and

injecting a fluidic material into the shoe; and

radially expanding at least a portion of the tubular liner by a process comprising:

adjusting the lower adjustable expansion device to a reduced outside diameter;

adjusting the upper adjustable expansion device to an increased outside diameter; and

injecting a fluidic material into the borehole below the lower adjustable expansion device.

62. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for adjusting the lower adjustable expansion device to an increased outside diameter; and

means for injecting a fluidic material into the shoe; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the lower adjustable expansion device to a reduced outside diameter;

means for adjusting the upper adjustable expansion device to an increased outside diameter; and

means for injecting a fluidic material into the borehole below the lower adjustable expansion device.

63. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

a first wellbore casing comprising:

an upper portion of the first wellbore casing; and

a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;

wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and

a second wellbore casing comprising:

an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;

wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second wellbore casing, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;

radially expanding at least a portion of the lower portion of the second wellbore casing shoe by a process comprising:

adjusting the lower adjustable expansion device to an increased outside diameter; and

injecting a fluidic material into the lower portion of the second wellbore casing; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the lower adjustable expansion device to a reduced outside diameter;

adjusting the upper adjustable expansion device to an increased outside diameter; and

injecting a fluidic material into the borehole below the lower adjustable expansion device.

64. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:

a support member including a first fluid passage;

an expansion device coupled to the support member including a second fluid passage fluidicly coupled to the first fluid passage;

an expandable tubular liner movably coupled to the expansion device; and

an expandable shoe coupled to the expandable tubular liner comprising:

a valveable fluid passage for controlling the flow of fluidic materials out of the expandable shoe;

an expandable portion comprising one or more inward folds; and

a remaining portion coupled to the expandable portion;

wherein the outer circumference of the expandable portion is greater than the outer circumference of the remaining portion;

wherein the expansion device is adjustable to a plurality of stationary positions.

65. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an adjustable expansion device, and a shoe in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

lowering the adjustable expansion device into the shoe;

adjusting the adjustable expansion device to a first outside diameter;

pressurizing a region within the shoe below the adjustable expansion device using a fluidic material; and

pressurizing an annular region above the adjustable expansion device using the fluidic material; and

radially expanding at least a portion of the tubular liner by a process comprising:

adjusting the adjustable expansion device to a second outside diameter;

pressurizing a region within the shoe below the adjustable expansion device using a fluidic material; and

pressurizing an annular region above the adjustable expansion device using the fluidic material;

wherein the first outside diameter of the adjustable expansion device is greater than the second outside diameter of the adjustable expansion device.

66. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an adjustable expansion device, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for lowering the adjustable expansion device into the shoe;

means for adjusting the adjustable expansion device to a first outside diameter;

means for pressurizing a region within the shoe below the adjustable expansion device using a fluidic material; and

means for pressurizing an annular region above the adjustable expansion device using the fluidic material; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the adjustable expansion device to a second outside diameter;

means for pressurizing a region within the shoe below the adjustable expansion device using a fluidic material; and

means for pressurizing an annular region above the adjustable expansion device using the fluidic material;

wherein the first outside diameter of the adjustable expansion device is greater than the second outside diameter of the adjustable expansion device.

67. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

a first wellbore casing comprising:

an upper portion of the first wellbore casing; and

a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;

wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and

a second wellbore casing comprising:

an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;

wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second wellbore casing and an adjustable expansion device in the borehole;

radially expanding at least a portion of the lower portion of the second wellbore casing by a process comprising:

lowering the adjustable expansion device into the lower portion of the second wellbore casing;

adjusting the adjustable expansion device to a first outside diameter;

pressurizing a region within the lower portion of the second wellbore casing below the adjustable expansion device using a fluidic material; and

pressurizing an annular region above the adjustable expansion device using the fluidic material; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the adjustable expansion device to a second outside diameter;

pressurizing a region within the shoe below the adjustable expansion device using a fluidic material; and

pressurizing an annular region above the adjustable expansion device using the fluidic material;

wherein the first outside diameter of the adjustable expansion device is greater than the second outside diameter of the adjustable expansion device.

68. An apparatus for forming a wellbore casing in a borehole located in a subterranean formation including a preexisting wellbore casing, comprising:

a support member including a first fluid passage;

a first adjustable expansion device coupled to the support member including a second fluid passage fluidicly coupled to the first fluid passage;

a second adjustable expansion device coupled to the support member including a third fluid passage fluidicly coupled to the first fluid passage;

an expandable tubular liner movably coupled to the first and second adjustable expansion devices; and

an expandable shoe coupled to the expandable tubular liner comprising:

a valveable fluid passage for controlling the flow of fluidic materials out of the expandable shoe;

an expandable portion comprising one or more inwards folds; and

a remaining portion coupled to the expandable portion;

wherein the outer circumference of the expandable portion is greater than the outer circumference of the remaining portion.

69. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

lowering the lower adjustable expansion device into the shoe;

adjusting the lower adjustable expansion device to an increased outside diameter;

pressurizing a region within the shoe below the lower adjustable expansion device using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion device using the fluidic material; and

radially expanding at least a portion of the tubular liner by a process comprising:

adjusting the lower adjustable expansion device to a reduced outside diameter;

adjusting the upper adjustable expansion device to an increased outside diameter;

pressurizing a region within the shoe below the lower adjustable expansion device using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion device using the fluidic material;

wherein the increased outside diameter of the lower adjustable expansion device is greater than the increased outside diameter of the upper adjustable expansion device; and

wherein the reduced outside diameter of the lower adjustable expansion device is less than or equal to the increased outside diameter of the upper adjustable expansion device.

70. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for lowering the lower adjustable expansion device into the shoe;

means for adjusting the lower adjustable expansion device to an increased outside diameter;

means for pressurizing a region within the shoe below the lower adjustable expansion device using a fluidic material; and

means for pressurizing an annular region above the upper adjustable expansion device using the fluidic material; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the lower adjustable expansion device to a reduced outside diameter;

means for adjusting the upper adjustable expansion device to an increased outside diameter;

means for pressurizing a region within the shoe below the lower adjustable expansion device using a fluidic material; and

means for pressurizing an annular region above the upper adjustable expansion device using the fluidic material;

wherein the increased outside diameter of the lower adjustable expansion device is greater than the increased outside diameter of the upper adjustable expansion device; and

wherein the reduced outside diameter of the lower adjustable expansion device is less than or equal to the increased outside diameter of the upper adjustable expansion device.

71. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

a first wellbore casing comprising:

an upper portion of the first wellbore casing; and

a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;

wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and

a second wellbore casing comprising:

an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;

wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second wellbore casing, an upper adjustable expansion device, and a lower adjustable expansion device in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

lowering the lower adjustable expansion device into the lower portion of the second wellbore casing;

adjusting the lower adjustable expansion device to an increased outside diameter;

pressurizing a region within the lower portion of the second wellbore casing below the lower adjustable expansion device using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion device using the fluidic material; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the lower adjustable expansion device to a reduced outside diameter;

adjusting the upper adjustable expansion device to an increased outside diameter;

pressurizing a region within the lower portion of the second wellbore casing below the lower adjustable expansion device using a fluidic material; and

pressurizing an annular region above the upper adjustable expansion device using the fluidic material;

wherein the increased outside diameter of the lower adjustable expansion device is greater than the increased outside diameter of the upper adjustable expansion device; and

wherein the reduced outside diameter of the lower adjustable expansion device is less than or equal to the increased outside diameter of the upper adjustable expansion device.

72. An apparatus for radially expanding and plastically deforming a tubular member, comprising:

means for injecting fluidic materials into the tubular member to radially expand and plastically deform the tubular member; and

means for radially expanding and plastically deforming the tubular member by displacing an expansion device within the tubular member.

73. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an adjustable expansion device, and a shoe in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

adjusting the adjustable expansion device to a first outside diameter; and

injecting a fluidic material into the shoe; and

radially expanding at least a portion of the tubular liner by a process comprising:

adjusting the adjustable expansion device to a second outside diameter; and

displacing the adjustable expansion device relative to the tubular liner.

74. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an adjustable expansion device, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for adjusting the adjustable expansion device to a first outside diameter; and

means for injecting a fluidic material into the shoe; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the adjustable expansion device to a second outside diameter; and

means for displacing the adjustable expansion device relative to the tubular liner.

75. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

a first wellbore casing comprising:

an upper portion of the first wellbore casing; and

a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;

wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and

a second wellbore casing comprising:

an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;

wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second wellbore casing and an adjustable expansion device within the borehole;

radially expanding at least a portion of the lower portion of the second wellbore casing by a process comprising:

adjusting the adjustable expansion device to a first outside diameter; and

injecting a fluidic material into the second wellbore casing; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the adjustable expansion device to a second outside diameter; and

displacing the adjustable expansion device relative to the tubular liner.

76. A method of forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

installing a tubular liner, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;

radially expanding at least a portion of the shoe by a process comprising:

adjusting the lower adjustable expansion device to an increased outside diameter; and

injecting a fluidic material into the shoe; and

radially expanding at least a portion of the tubular liner by a process comprising:

adjusting the lower adjustable expansion device to a reduced outside diameter;

adjusting the upper adjustable expansion device to an increased outside diameter; and

displacing the upper adjustable expansion device relative to the tubular liner.

77. A system for forming a wellbore casing in a subterranean formation having a preexisting wellbore casing positioned in a borehole, comprising:

means for installing a tubular liner, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;

means for radially expanding at least a portion of the shoe comprising:

means for adjusting the lower adjustable expansion device to an increased outside diameter; and

means for injecting a fluidic material into the shoe; and

means for radially expanding at least a portion of the tubular liner comprising:

means for adjusting the lower adjustable expansion device to a reduced outside diameter;

means for adjusting the upper adjustable expansion device to an increased outside diameter; and

means for displacing the upper adjustable expansion device relative to the tubular liner.

78. A wellbore casing positioned in a borehole within a subterranean formation, comprising:

a first wellbore casing comprising:

an upper portion of the first wellbore casing; and

a lower portion of the first wellbore casing coupled to the upper portion of the first wellbore casing;

wherein the inside diameter of the upper portion of the first wellbore casing is less than the inside diameter of the lower portion of the first wellbore casing; and

a second wellbore casing comprising:

an upper portion of the second wellbore casing that overlaps with and is coupled to the lower portion of the first wellbore casing; and

a lower portion of the second wellbore casing coupled to the upper portion of the second wellbore casing;

wherein the inside diameter of the upper portion of the second wellbore casing is less than the inside diameter of the lower portion of the second wellbore casing; and

wherein the inside diameter of the upper portion of the first wellbore casing is equal to the inside diameter of the upper portion of the second wellbore casing;

wherein the second wellbore casing is coupled to the first wellbore casing by the process of:

installing the second wellbore casing, an upper adjustable expansion device, a lower adjustable expansion device, and a shoe in the borehole;

radially expanding at least a portion of the lower portion of the second wellbore casing shoe by a process comprising:

adjusting the lower adjustable expansion device to an increased outside diameter; and

injecting a fluidic material into the lower portion of the second wellbore casing; and

radially expanding at least a portion of the upper portion of the second wellbore casing by a process comprising:

adjusting the lower adjustable expansion device to a reduced outside diameter;

adjusting the upper adjustable expansion device to an increased outside diameter; and

displacing the upper adjustable expansion device relative to the tubular liner.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/00609

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : E21B 43/10
US CL : 166/380, 207
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 166/380, 207, 212, 216, 217

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002/0033261 A1 (METCALFE) 21 March 2002 (21.03.02), summary.	1-55
A	US 6,085,838 A (VERCAEMER et al.) 11 July 2000 (11.07.02), figures 5-7.	1-55

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search	Date of mailing of the international search report
15 April 2003 (15.04.2003)	20 MAY 2003
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer David Bagnell Telephone No. (703) 308-1113

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